

## THE GENUS FLAMMULASTER

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In 1960, Orton described the new genus *Flocculina* to cover a group of small naucoroid agarics which had formerly been placed together by Kühner and Romagnesi (1953) in their newly suggested subgenus of *Naucoria*, *Floccularia*. Orton, with whom I agree, considered this group of fungi homogeneous and worthy of separation from true *Naucoria* spp. e.g. *Agaricus escharoides* Fr. per Fr., a group which Kühner had formerly called *Alnicola* (1926). *Floccularia*, however, was not available to Orton for use at generic level because Pouzar (1957) had already used it for *Armillaria luteovirens*, *Amanitaceae*. Orton also considered it essential to recognise a distinction between his new genus and *Phaeomarasmius*, a genus which Singer (1951) considerably expanded to include *Naucoria carpophila* and its associates, and *Flammula limulata* and related fungi. The common *Naucoria granulosa*, well illustrated in Lange's Flora Agaricina Danica (1938), was chosen by Orton as the type of *Flocculina*. On careful examination, however, the genus circumscribes a group already recognised by Earle as early as 1909 under a different name, *Flammulaster*, a genus embracing *Naucoria*, III Lepidotae of the Sylloge Fungorum (1887). Earle's genus is based on *Naucoria carpophila* and was unfortunately overlooked by Orton: the correct citation of the type species is *Flammulaster carpophila* (Fr. per Fr.) Earle in Bull. N. Y. Bot. Gdn. 5: 435 (1909).

I propose to support Orton's idea of retaining *Flocculina*, now *Flammulaster* as distinct from *Naucoria*, with type species *Agaricus escharoides* Fr. per Fr., and *Phaeomarasmius*, with type species *P. excentricus* Scherff. and to support Singer (1951) in his separation of this same group (plus *Naucoria horizontalis* etc.) from the *Naucoria centunculus* group (= *Simocybe* Karst.). In doing so I find therefore the necessity to propose the following new combinations:—

### 1. *Flammulaster carpophiloides* (Kühn.) Watling, comb. nov.

Basionym *Naucoria carpophiloides* Kühn. in Bull. Soc. Nat. Oyonnax 10–11, Suppl.: 5 (1957).

Syn.: *Phaeomarasmius carpophiloides* (Kühn.) Moser apud Gams, 1955.  
*Flocculina carpophiloides* (Kühn.). P. D. Orton, 1960.

### †2. *Flammulaster erinaceella* (Peck) Watling, comb. nov.

Basionym *Agaricus erinaceellus* Peck in Rep. N. Y. St. Mus. 31: 70 (1878).

Syn.: *Pholiota erinaceellus* (Peck) Peck, 1908.

*Phaeomarasmius erinaceellus* (Peck) Singer & Digilio, 1951, excl. descrip.

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† There are small differences between the British material cited in this account and material collected in North America; further studies are pending.

*Flocculina erinaceella* (Peck) P. D. Orton, 1960.

*Agaricus detersibilis* Peck, 1876 non *A. detersibilis* Berk. & Curt., 1853 (= *Collybia*).

as *Naucoria wieslandri* (Fr.) Sacc. in Kühner, Bull. Soc. Nat. Oyonnax 10-11, Suppl.: 29 (1957).\*

**3. Flammulaster ferruginea** (R. Maire apud Kühn.) Watling comb. nov.

Basionym *Naucoria ferruginea* R. Maire apud Kühn. in Bull. Soc. Nat. Oyonnax 10-11, Suppl.: 5 (1957).

Syn.: *Flocculina ferruginea* (R. Maire apud Kühn.) Orton, 1960.

? *Naucoria siparia* f. *umbonata* Romagn. in Bull. Soc. myc. Fr. 63: 149 (1942).

as *Naucoria siparia* (Fr.) Gillet in J. Lange, Flora Agaricina Danica 4, 19 (1940).

as *N. siparia* (Fr.) Gillet in Kühner & Romagnesi, Flore Analytique des Champignons Supérieurs, 241 (1953).

**4. Flammulaster fusispora** (P. D. Orton) Watling, comb. nov.

Basionym *Flocculina fusispora* P. D. Orton in Trans. Brit. mycol. Soc. 43: 235 (1960).

Syn.: *Naucoria fusispora* (P. D. Orton) Romagn., 1962 (basionym not clearly stated).

**5. Flammulaster granulosa** (J. Lange) Watling, comb. nov.†

Basionym *Naucoria granulosa* J. Lange in Flora Agaricina Danica 5: vi (1940).

Syn.: *Phaeomarasmius granulosus* (J. Lange) Singer, 1951.

*Flocculina granulosa* (J. Lange) P. D. Orton, 1960.

**6. Flammulaster limulata** (Fr. per Weinm.) Watling, comb. nov.

Basionym *Agaricus limulatus* Fr. per Weinm. in Hymenomycetes Rossiae 201 (1836).

Syn.: *Flammula limulata* (Fr. per Weinm.) Karst, 1879.

*Dryophila limulata* (Fr. per Weinm.) Quélet, 1886.

*Fulvidula limulata* (Fr. per Weinm.) Romagn., 1937.

*Phaeomarasmius limulatus* (Fr. per Weinm.) Singer, 1956.

*Flocculina limulata* (Fr. per Weinm.) P. D. Orton, 1960.

**7. Flammulaster muricata** (Fr. per Fr.) Watling, comb. nov.

Basionym *Agaricus muricatus* Fr. per Fr. in Syst. Mycol. 1: 244 (1821).

\* *Agaricus* (*Naucoria*) *wieslandri* Fries needs further study; in the sense of Singer (1956) it is a fungus which grows on soil in woods and with fairly large spores (7.5-9.2 (10.8) × 3.5-4.6 µ). It is not authentically British but see *F. gracilis* (Quélet) § 15.

† Careful observations are required on this taxon and related agarics for Kühner (1957) described a collection from Lyon, 15 xii 1911 (Chemin de Champvert, aux Massues) which had differently shaped spores to those from the herbarium material cited in the text.

Syn.: *Pholiota muricata* (Fr. per Fr.) Kummer, 1871.

*Dryophila muricata* (Fr. per Fr.) Quélet, 1886.

*Phaeomarasmius muricatus* (Fr. per Fr.) Singer, 1956.

*Flocculina muricata* (Fr. per Fr.) P. D. Orton, 1960.

**8. Flammulaster pusillima** (P. D. Orton) Watling, comb. nov.

Basionym *Flocculina pusillima* P. D. Orton, in Trans. Brit. mycol. Soc. 43: 236 (1960).

Syn.: *Naucoria pusillima* (P. D. Orton) Romagn., 1962.

as *N. speireoides* Romagn. in Bull. Soc. Nat. Oyonnax 10-11, Suppl.: 17 (not p. 6) (1957).

**9. Flammulaster rhombospora** (Atk.) Watling, comb. nov.

Basionym *Lepiota rhombospora* Atk. in Proc. Amer. Phil. Soc. 57: 356 (1918).

Syn.: *Naucoria rhombospora* (Atk.) Favre, 1948.

*Phaeomarasmius rhombosporus* (Atk.) Moser apud Gams, 1953. (Basionym not clearly stated).

*Flocculina rhombospora* (Atk.) P. D. Orton, 1960.

**10. Flammulaster siparia** (Fr.) Watling, comb. nov.

Basionym *Agaricus siparia* Fr., in Syst. Mycol. 1: 261 (1821).

Syn.: *Naucoria siparia* (Fr.) Gillet, 1874.

*Phaeomarasmius siparia* (Fr.) Singer, 1951.

*Flocculina siparia* (Fr.) P. D. Orton, 1960.

**11. Flammulaster subincarnata** (Joss. & Kühn. apud Kühn.) Watling, comb. nov.

Basionym *Naucoria subincarnata* Joss. & Kühn. apud Kühn. in Bull. Soc. Nat. Oyonnax 10-11, Suppl.: 6 (1957).

Syn.: *Flocculina subincarnata* (Joss. & Kühn. apud Kühn.) P. D. Orton, 1960.

as *Naucoria pygmaea* (Bull. per Fr.) Gillet in R. Heim. & H. Romagnesi Bull. Soc. myc. Fr. 50: 173 (1934); ≠ *N. pygmaea* (Bull. per Fr.) Gillet 1874.

as *Phaeomarasmius pygmaeus* (Bull. per Fr.) Sing. in Singer, Lilloa 22: 578 (1951) and in Moser, Gams Kleine Kryptogamenflora 2nd edition, 168 (1955).

There is little doubt that the fungus described by Romagnesi in 1957 under *Naucoria speireoides* belongs to *Flammulaster*, as does Kühner's *N. delicatuloides*. Favre's *N. saliciphila* and the fungus Singer (1956) interpreted as *N. gracilis* Quélet can be also assigned to the genus *Flammulaster*.\* I, however, have not examined material of these species.

\* *Phaeomarasmius pityrodes* (Brig. per Fr.) Moser apud Gams, 1955 (= *Agaricus pityrodes* Brig.) probably belongs in this genus. *Naucoria stagninoides* Orton, 1960 on the other hand does not belong here.

**12. Flammulaster speireoides** (Romagn. apud Kühn.) Watling, comb. nov.  
 Basionym *Naucoria speireoides* Romagn. apud Kühn. in Bull. Soc. Nat. Oyonnax 10-11, Suppl: 6 (1957).

**13. Flammulaster delicatuloides** (Kühn.) Watling, comb. nov.  
 Basionym *Naucoria delicatuloides* Kühn. in Bull. Soc. Nat. Oyonnax 10-11, Suppl: 5 (1957).

**14. Flammulaster saliciphila** (Favre) Watling, comb. nov.  
 Basionym *Naucoria saliciphila* Favre in Les associations fongiques des hauts marais jurassiens et quelques régions voisines, 214 (1948).  
 Syn.: *Phaeomarasmius saliciphila* (Favre) Moser apud Gams, 1955 (Basionym not clearly stated).  
*Flocculina saliciphila* (Favre) P. D. Orton, 1960.

**15. Flammulaster gracilis** (Fr. per Quélet) Watling, comb. nov.  
 Basionym *Pholiota muricata* var. *gracilis* Quélet in Bull. Soc. Ann. Sc. Nat. Rouen, 40 (1880).  
 Syn.: *Naucoria muricata* var. *gracilis* (Fr. per Quélet) Romagnesi, 1942.  
*Phaeomarasmius gracilis* (Fr. per Quélet) Singer, 1961.  
 as *N. wieslandri* (Fr.) Sacc. pro parte in Kühner & Romagnesi Flore Analytiques des Champignons Supérieurs, 242 (1953).

**16. Flammulaster microspilia** (Romagn. apud Kühn.) Watling, comb. nov.  
 Basionym *Naucoria microspilia* Romagn. apud Kühn. in Bull. Soc. Nat. Oyonnax 10-11 Suppl: 5 (1957).  
 as *Naucoria carpophila* Fr. Romagnesi Rev. Myc. 8:31 (1943).

**17. Flammulaster harissonii** (Dennis) Watling comb. nov.  
 Basionym *Phaeomarasmius harissonii* Dennis in Kew Bull. 19: 113 (1964).

No. 9 in the above enumeration, *F. rhombospora*, has not been previously collected in the British Isles and a full description is appended. Field notes have been compared and agree with material collected in North America. The British material also agrees with notes from the type material (Nos. 24323 & 24324 CUP; in edge of mixed wood on leaf-mould by Stewart's Camp, 7th Lake, Adirondack Mts., 16 & 21 August 1917).

*Pileus* 5-10 mm convex, soon expanding, pale creamy buff or slightly yellow ochraceous particularly towards the darker disc, dull, matt, very minutely scurfy, atomate. *Stipe* 25-32 × 0.5-1.0 mm concolorous or slightly paler than pileus, apex whitish, pruinose, lower part scurfy flocculose, hollow to stuffed, equal or slightly tapered. *Gills*, adnate, sometimes emarginate with slight tooth to slightly ventricose, ochraceous buff or pale honey with paler to whitish floccose margin. *Flesh* concolorous in pileus, slightly honey over gills and in stipe apex, whitish honey in main area of stipe. *Basidiospores* (6) 7-9 × 4-5  $\mu$  smooth, limoniform with basal papilla and

prominent apiculus ('turnip shaped'), pale honey, thin-walled. *Cheilocystidia* cylindric flexuous or slightly lageniform to narrowly urtica-hair shaped  $30-40 \times 5-7 \mu$ ; *pleurocystidia* absent. Cells of pileus granulation vesiculose slightly ellipsoid, smooth or sometimes with external wall granulose.

On debris of *Salix cinerea* under dense shade, Buckie Loch, Culbin sands, Morayshire, 17 viii 1964. Wat. Herb. 953C and 948C.

Although originally described in *Lepiota* it is a typical member of the genus *Flammulaster*; by Singer it would be placed in *Phaeomarasmius* subgenus and section *Carpophilus*. Atkinson himself noted the vesiculose cells constituting the veil and the pale, uniquely shaped spores.

The fungi which have been discussed so far have all been associated by Singer with *Pholiota confragosa* (Fr.) Karst, in *Phaeomarasmius*. However, after examination of several fresh collections of *Pholiota confragosa* (A51/C1930; A863/C1298 A2115/C2514 etc.) I prefer to separate this from the *Naucoria carpophila* and *Flammula limulata* groups. *P. confragosa* is probably much more closely related to *Tubaria furfuracea*, *T. pellucida* and *T. conspersa* and if this approach were adopted it would make the hiatus between *Phaeomarasmius* and *Flammulaster* more understandable. Kühner (1935) has previously placed *Naucoria carpophila* in *Tubaria* and later he and Romagnesi (1953) placed the same fungus (under their subgenus *Floccularia*) in the genus *Naucoria* in which *Tubaria* was also included as a subgenus. It is of interest to note that Smith & Shaffer (1964) go one stage further and whilst recognising *Tubaria* as a distinct genus place *N. carpophila* in it under the section *Cystotubaria* (nomen nudum). Certainly the anatomy of the fruit-body and morphology of the basidiospores support this treatment. When consulting Earle's original description of this genus it is very significant to note that he envisaged a connection with the tubarioid *Naucoria* spp. because he states that his new genus 'is *Naucoria Lepidotea* of the Sylloge and it also includes a considerable number of species that are placed in *Tubaria*'.

The darker spored group (i.e. *F. limulata*) approach more closely members of the genus *Pholiota* than *Tubaria* spp., particularly North American taxa; the genus *Flammulaster* superficially appears to be a bridging group between the two. However, further work is required particularly on development to clarify this point and to explore the possibilities of a connection with *Phaeolepiota aurea* currently placed in the *Agaricaceae*.

Material examined: *F. carpophila*, Glenrosa, Mickleham, Surrey 7 xi 1954, Orton 292; Glenrosa, Mickleham, Surrey 11 xi 1954, Orton 293; Guisachan, Inverness-shire, 1 ix 1957, Orton 1173 (all as *Flocculina*); on roadside Plodda, Inverness-shire, 31 viii 1957, Watling 129C (as *Naucoria*).

This material agrees with that distributed as No. 2037 Fungi Exs. Suecici Prasertim Upsalienses: Lundell & Nannfeldt, on pericarps of beech, buried amongst leaves, after heavy rain, Västergötland: Göteborg, St. Anggården "Naturparken" 18 vii and 12 viii 1942.

*F. carpophiloides*, Allerford Wood, Somerset, 7 xi 1959, Orton 1963.

*F. erinaceella*, Allerford Wood, Somerset, 7 xi 1959, Orton 2033; Leigh Wood, Somerset, 14 ix 1955, Orton 580; in field, Boxhill, Surrey 4 x 1955, Orton 583; Bindon Landslip, Rousdon, Devon 29 xi 1958, Orton 1525; Bindon Landslip, Rousdon, Devon, 2 xii 1958, Orton 1526; Dowlands Landslip, Rousdon, Devon, 18 vi 1959, Orton 1964, (all as *Flocculina*).

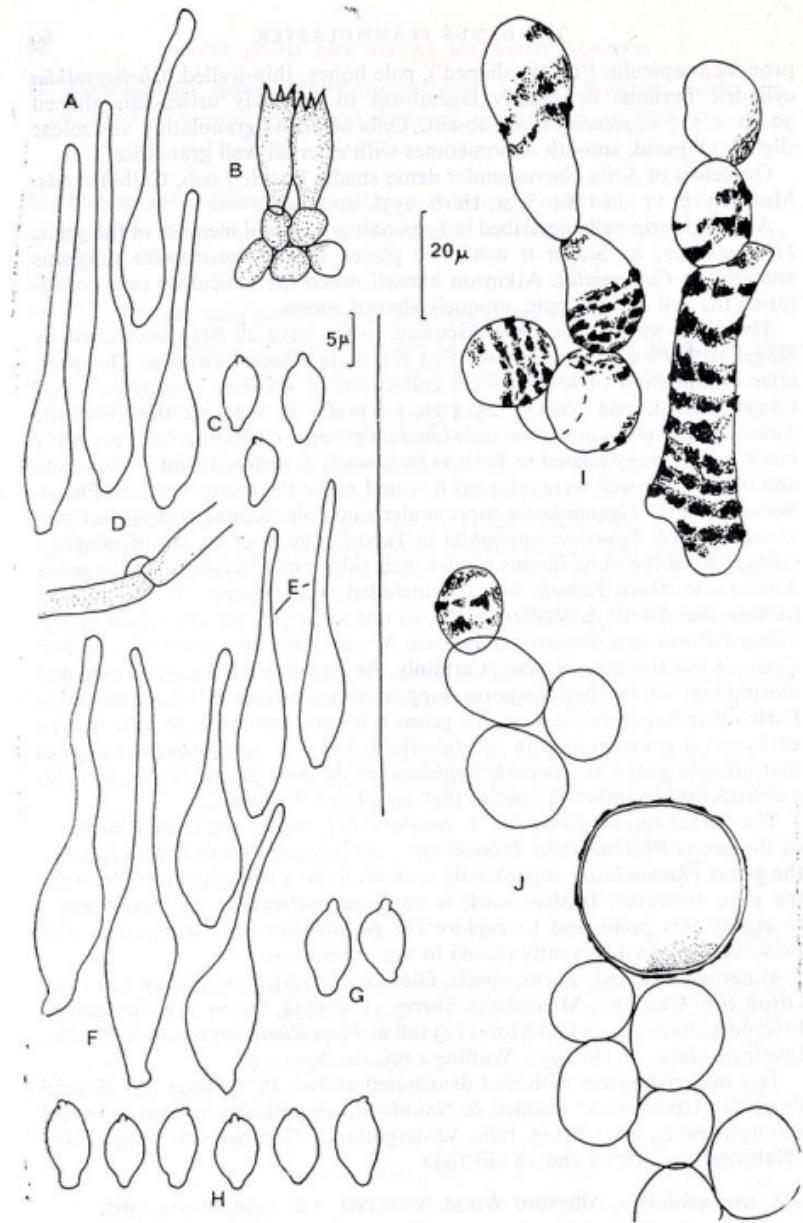


FIG. 6. *Flammulaster rhombospora* (Atk.) Watling. A. E. & F. Cheilocystidia. B. Basidia and cells of subhymenium. C. G. & H. basidiospores. D. Clamp-connections from hymenophoral trama. I. Loose cells from pileus surface as seen in a 'Pileus Scalp'. J. Loose cells of pileus surface as seen in a transverse section of pileus.  
A. & C. Watling A610/1133C, B. D. F. G. I. and J. Watling 953C, E & H Watling 948C.

(Several herb. collections from Michigan have been examined and the material in the Michigan University Herbarium consulted: cf. collections from Chippewa Co., Michigan, Watling A2103/C2451; A2101/C2449; A2102/C2450 etc.).

*F. ferruginea*, Loch Rannoch, Perthshire, 30 viii 1954, Orton 291; Loch-an-Eilean, Inverness-shire, 27 ix 1955, Orton 581; Surlingham Wood, Norfolk, 22 x 1956, Orton 897; Surlingham Wood, Norfolk, 18 x 1957, Coll. E. A. Ellis, Orton 1174; Tuck's Plantation, Surlingham, Norfolk, 21 x 1957, Orton 1175; Black Park, Rothiemurchis, Inverness-shire, 29 v 1960, Orton 2135 (all as *Flocculina*).

*F. fusispora*, Surlingham Wood, Norfolk, 11 x 1957, Orton 1178 (as *Flocculina*) Kingthorpe, Yorks, 14 ix 1959, Coll. Dr. C. J. P. La Touche, Orton, 1941 (Type of *Flocculina fusispora*, E) (On decaying leaves in damp area by path—R. W.).

*F. granulosa*, Malham, Yorks. 9 ix 1952, Orton 36; Langcliffe Brae, Settle, Yorks. 17 ix 1953, Orton 90; Mickleham Downs, Surrey, 19 xi 1954, Orton 294; Mickleham Downs, Surrey, 5 xii 1954, Orton 295; Bindon Landslip, Rousdon, Devon, 2 xii 1958, Orton 1927; Wheatfen, Surlingham, Norfolk, 10 x 1957, Orton 1176; Bindon Landslip, Rousdon, Devon, 2 xii 1958, Orton 1528 (all as *Flocculina*); under *Acer*, on soil Tarn House Plant., Malham, 31 viii 1958, Watling 181C; on old debris and soil, Scarborough, Yorkshire, 4 v 1962, Watling 462C (as *Naucoria*).

*F. limulata*, Plodda, Guisachan, Inverness-shire, 2 ix 1957, Orton 1177 (as *Flocculina*) (on old wood (coniferous?) by logging road—R. W.); on rotten wood Michigan, U.S.A.: Whitehouse Landing, Chippewa Co., Watling 1043A/1452C; Emerson, Chippewa Co., Watling 1320A/1625C; Douglas Lake, Cheboygan Co., Watling 1200A/1540C; Washentaw Co., Watling 1335A/1637C; also Chippewa Co., Watling 1335A/1637C, 1200A/1540C, A1043/1452C etc.

*F. pusillima*, Clapham Woods, Yorks. 27 viii 1950, Orton 1528 (Type of *Flocculina pusillima*, E) (on leafy debris close to pathside under fairly dense shade in damp area of wood—R. W.).

*F. siparia*, on roadside Plodda, Inverness-shire, 31 viii 1957, Watling 103C Coll. 1. (as *Naucoria*); on old twigs Clapham Wood, Yorkshire, 23 viii 1958, Watling 103C Coll. 2 (as *Naucoria*).

*F. subincarnata* Mickleham Downs, Surrey 20 x i 1953, Orton 93; Mickleham Downs, Surrey 24 xi 1953, Orton 94; Billybank Wood, Richmond, Yorkshire, 30 ix 1956, Orton 896 (under *Fagus*, on woody debris by pathside—R. W.); Guisachan, Inverness-shire 31 viii 1957, Orton 1179 (all as *Flocculina*); on woody debris Clapham Wood 21 ix 1957, Watling 66C (as *Naucoria*); Riggessville Road, Cheboygan, Michigan, U.S.A. 12 vii 1965 (on very rotten wood) Watling A1711/2345C; on dead leaves Clapham Wood, nr. Austwick 24 viii 1958, Henderson 4131 (as *Naucoria*).

*F. rhombospora* on roadside, near gravel pit, Sugar Island, Chippewa Co., Michigan, U.S.A. 9 viii 1965, Watling A1029/1434C; and collections cited in text.

*F. harrisonii* Type (K) Associated with *Oligothricum hercynicum* and *Nardia scalaris* Ainsworth, Isle of Rhum, Scotland, 3 ix 1962.

The Check List authors (Dennis, Hora and Orton 1960) simply state *Flammula limulata* Fr. s. Bresadola (1931) "doubtful". The figure certainly does not suggest a *Flammulaster*. Henderson 2381 (E) on old Scots Pine sawdust, and collected in Ross-shire may represent this fungus (10th October 1955) and although it has a similar spore size the spores differ in structure from those of *limulata* as do the cheilocystidia and trama.

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